AMENDMENTS TO THE SPECIFICATION

Please insert the following paragraphs between paragraph **[0032]** and **[0033]**:

[0032.1] The denoising process as applied to the modified cascaded sweep data of the four sweep segment example of **Figure 1c** is further described with reference to the flowchart of **Figure 5**. Cascaded sweep data are acquired **501** by recording data created by energy output from a vibrator source using a cascaded sweep series. The recorded data are then modified **503** as described for **Figure 1c** so that the initial sweep segment (Sw1) and final listen time (L4) are combined to form the initial segment **131** of the modified cascaded sweep data. A preferred method for combining a first sweep and final listen time is by time series addition.

[0032.2] As shown in **Figure 5**, a first data segment is selected as the target to denoise **505**. In this example **131** is the first data segment. Any or all other "second" data segments (in this example any or all of segments **114**, **118**, **122**) are phase shifted **207** to the phase corresponding to the phase of the sweep segment of the first data segment. A phase shift will be applied to each data segment so that the phase of the data segment's sweep segment phase corresponds to the phase of the first or target data segment. The first data segment **131** of the present example corresponds to the phase of sweep Sw1. The phase shift applied to the data segment **114** is a phase shift to change the phase of sweep segment Sw2 to the phase of the sweep Sw1. A phase shift is applied to data segment **118** that will change the phase of sweep segment Sw3 to the phase of

sweep Sw1. The data segment **122** is phase shifted from the phase of the sweep segment Sw4 to the phase of sweep Sw1.

[0032.3] In order to detect coherent noise, the data of the different data segments are compared. A difference between a first data segment and one or more of the second or other data segments is determined for the comparison. While numerical differences between data segments may be determined directly, comparing data measures of the data segments provides better sensitivity. In one embodiment, the different data segments are compared using data measures within short time windows (for example windows ranging in length between 4ms to 500ms) using root-mean-square (RMS) values (this may accomplished in step **509** as disclosed at **209**). The root-mean-square may be defined as the square root of the average of the squares of the samples within the data population, with the data population being the samples in corresponding data windows. Other data measures may be used for comparison within short windows, for example, measures of data power or data magnitude averages. The short windows for data comparison may be overlapped. If a window RMS value in the current target data segment **131** deviates too much (for example, exceeds a specified threshold) from that of the corresponding windows in all other data segments (**114**, **118**, **122**), or a combination of the other data segments, the window data in the current target data segment are replaced by an estimate of the signal. A specified threshold may be determined by methods well known in the art, for example the threshold may be based on measurements of amplitude, phase or frequency and may be combined with other parameters, for example, time and position. A specified threshold may be data dependent and may be variable from record to record.

The estimate of the signal to be used for the replacement data may be derived from one or more of the other data segments. While the estimate of the signal to be used for the replacement data is derived using phase shifted data, the determination of the data measure for comparison (using RMS values in the preferred embodiment) may be prior to phase shifting the data segments.

[0032.4] A window in a data segment will have corresponding windows in the other data segments. For example, a data trace in **131** with a window between 100ms to 200ms as measured from the start of the sweep segment will have a corresponding window in the same trace of **114**, **118** and **122** as measured from the start time of each of the sweep segments for those data segments.

[0032.5] The data used to replace target segment data exceeding a threshold is derived from at least one of the other data segments (**114**, **118** and/or **122**). The replacement data, for example, can be the arithmetic average of the corresponding window data from one or more of the other data segments. Other averages used for replacement data may be a median or weighted average. In this example the arithmetic average of **114**, **118** and **122** would be used to replace data in **131**. If the target data segment comparison with at least one other data segment shows data deviation is negligible or does not fall above a specified threshold, the data remain unchanged.

[0032.6] After comparing data segments and replacing data if required, the data segments (**131**, **114**, **118** and **122**) are stacked **511** to form a new target data segment. The

stack of these data segments, the new target data segment, is the final denoised target data segment.

[0032.7] This process is repeated **513** by selecting other segments as a target segment from the modified data. In the same manner as for the initial target data segment, a phase shift is applied to the non-target data segments that will shift the non-target data segments' corresponding sweep segment phase to the sweep segment phase corresponding to the target data segment. In this example, **114**, **118** and **122** are individually treated as target data segments in the manner disclosed for **131**. The final denoised target data segments are the stack combinations of all the data segments after phase shifting the data segments to the phase corresponding each target data segment's sweep segment phase.

[0032.8] Finally the listen time is extracted **515** from the first segment (**131** in this example) and is appended at the end of the denoised cascaded sweep data (cf. **Figure 1d**). A preferred method of extracting the listen time is by applying a time-varying low-cut filter to the denoised initial segment assuming upsweeps were used. The data may then be passed on to other data processing routines **517**.